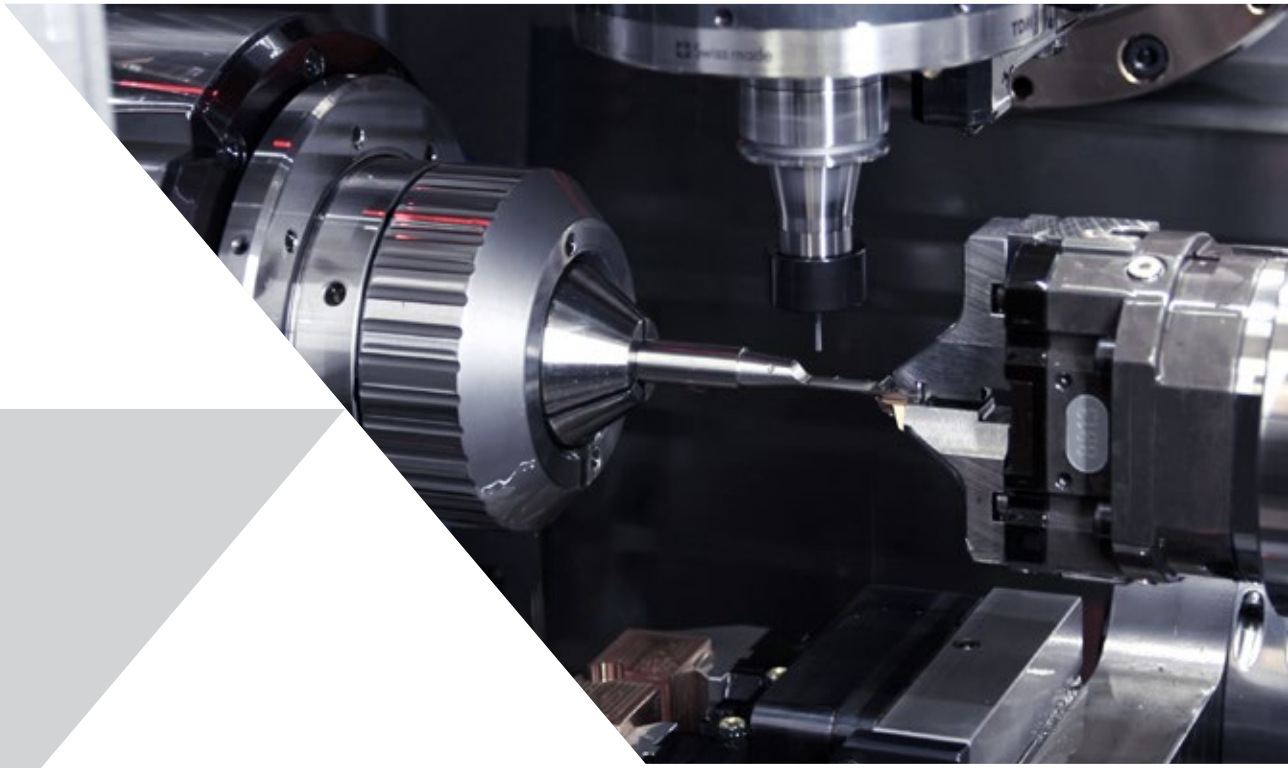
starrag

bumotec

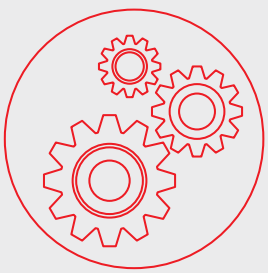
s191H
High precision CNC mill/turn



s191, THE COMPLETE SOLUTION

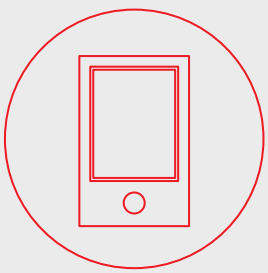
The Bumotec s191 HORIZONTAL is the result of blending ''Swiss'' mechanics and state-of-the-art axis drive technologies.

The cast iron machine base and travelling column eliminate vibrations in a perfect way. The advanced cinematics allow the implementation of numerous machining operations at a very small footprint. The combination of milling and turning grants the machining of most different, complex parts in hard-to-machine and precious materials.



Micro-Mechanics

Watch-Making



Electronics

SWISS MADE

- Complete machining solution
- Working from bar or raw parts
- Bar capacity Ø32/50/65 mm
- Outstanding modularity
- Acceleration 1,2 g
- Rapids 50 m/min
- Linear motors & drives
- Ramp-up 0 to 30 000 rpm in 1,5 s
- 90° tilt in 0,35 s
- Up to 7 axes and three spindles
- Turn/mill and multiple other operations
- Tool magazine 30 / 60 or 90 pockets
- 5 axes simultaneous machining

Medical **Aerospace** **Jewelry**

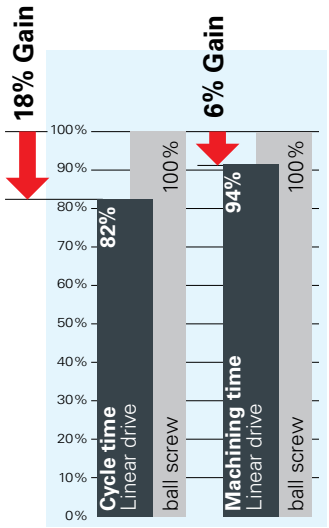
DIRECT DRIVE TECHNOLOGY AND OUTSTANDING THERMAL STABILITY

- Higher precision and repeatability
- Better surface finish
- Faster cycle times
- Reduced Maintenance

Linear Motor Drive Option for the Z and Y axis
Linear motor slides provide a step up in production speed, quality and stability while eliminating maintenance.

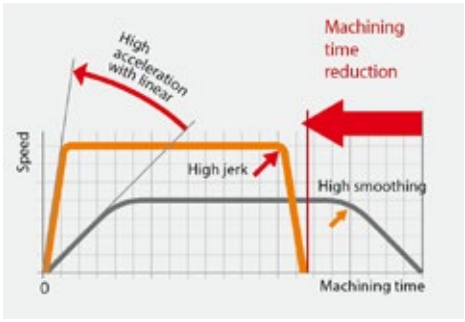
Ball Screw vs. Linear Motor Considerations

Criterion	Linear Motor Drive	Ball Screw Drive
Acceleration	Up to 1,2 g	0,9 g, physical limitation of the ball screw
Speed	Only limited by linear guides	Physical limitation of the ball screw
Wear	None	High, particullary while fast movements
Reliability	Very High	High
Components	No mechanical coupling	Ball screw, nut, coupling, drive etc.
Cooling	Necessary	Necessary while fast movements
Backlash	Zero over lifetime	minimal but increase with wear

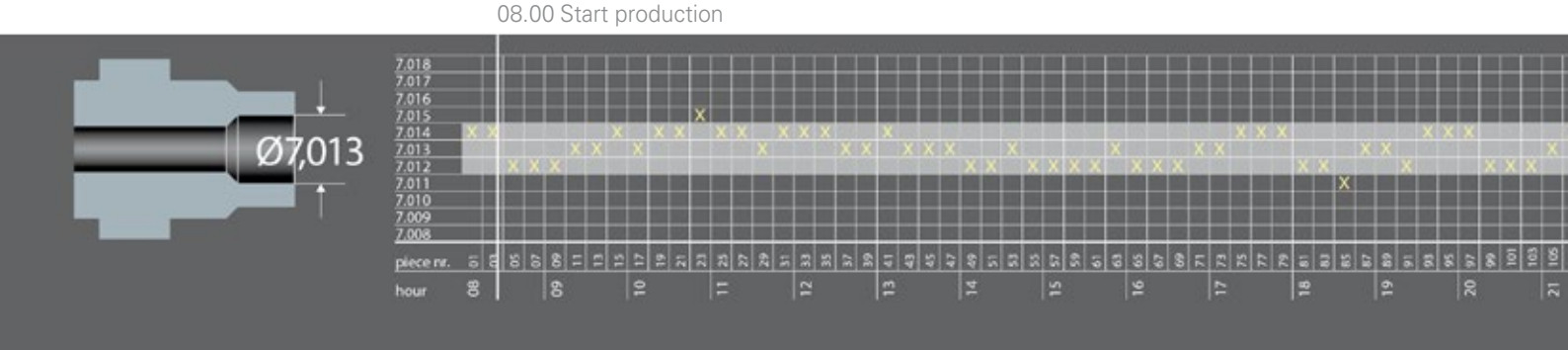


Reduction of cycletime
Comparison of cycle time between a machine with ball-screw and linear drive technology.

The Additional Advantage of Speed
- Reduction of bi-times
- Better dynamics and finishes at higher speeds.



08.00 Start production



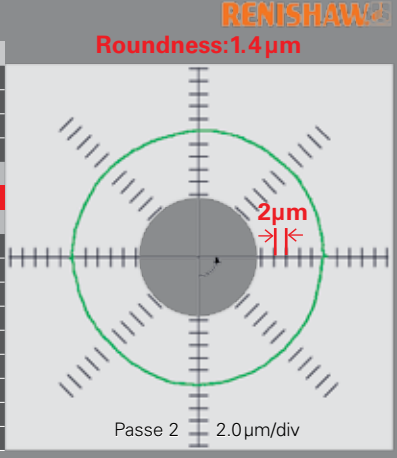
Exceptional Surface Quality
State-of-the-Art control and drive technology combined with proven mechanics support the achievement of best surface qualities at short mfg time.
Below: Complex bracelet component with preparation for stone setting in 316 L.

Contouring precision
The combination of linear drives and 1/100 µm glass scales facilitates outstanding levels of precision and interpolation quality.
Below: Renishaw BallBarTest printout (radius 50 mm).

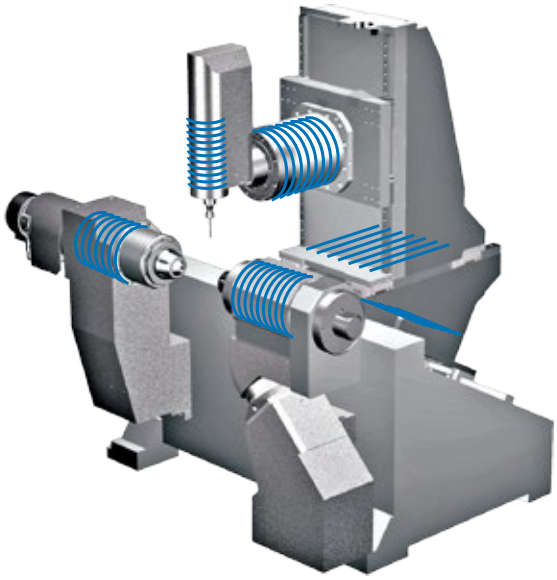
ISO 230-4 Circular deviations

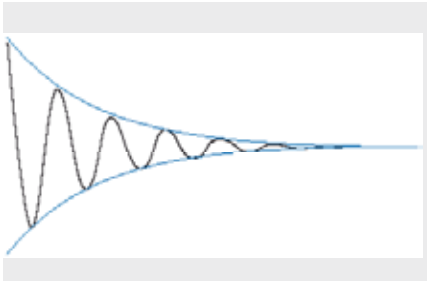
RENISHAW

X,Y 360 test 2	
Instrument	BallbarQC10
Machine	Bumotec s191H
Operator	gachoudb
Date	04.09.15 16h50
Circular deviations (SAH)	
Value	1.4µm
Testing parameters	
Radius	50 0000 mm
Calibration Frequency	41.667Hz
Feedrate	500 mm/min
Cutting procedure	SAH
Measuring plane	XY
Measuring position	
Starting angle	270°
Exit angle	270°
Angular overlap	180°

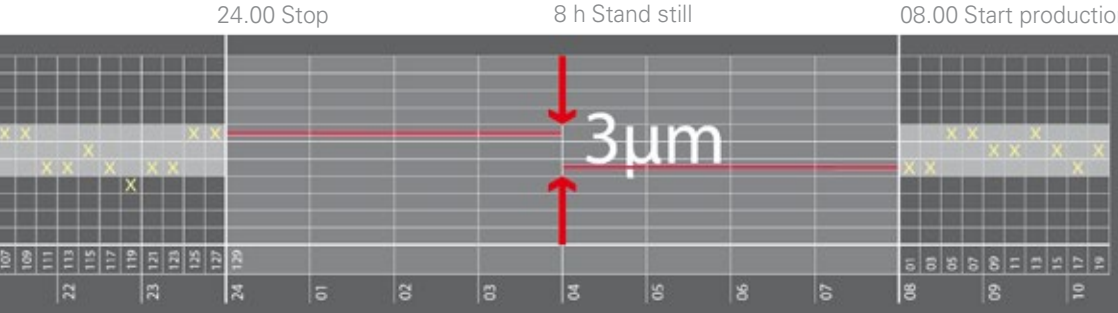


Cooling system
A stabilized cooling circuit enables a very regular production and almost eliminates warm-up cycles when starting or after interruptions.





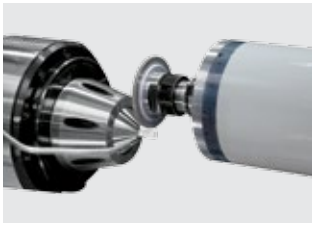
The reduction of mechanical components
helps eliminate vibrations and wear, ensuring a steep increase in precision and positioning, even at high speeds. The result is exceptional surface quality and excellent tool life.

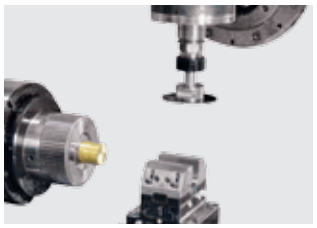


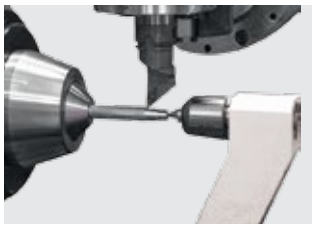
Example of unmanned manufacturing in automatic mode. One observes the little dimensional dispersion and the perfect compliance with tolerances at the restart after an 8 hours interruption.

A MODULAR CONCEPT

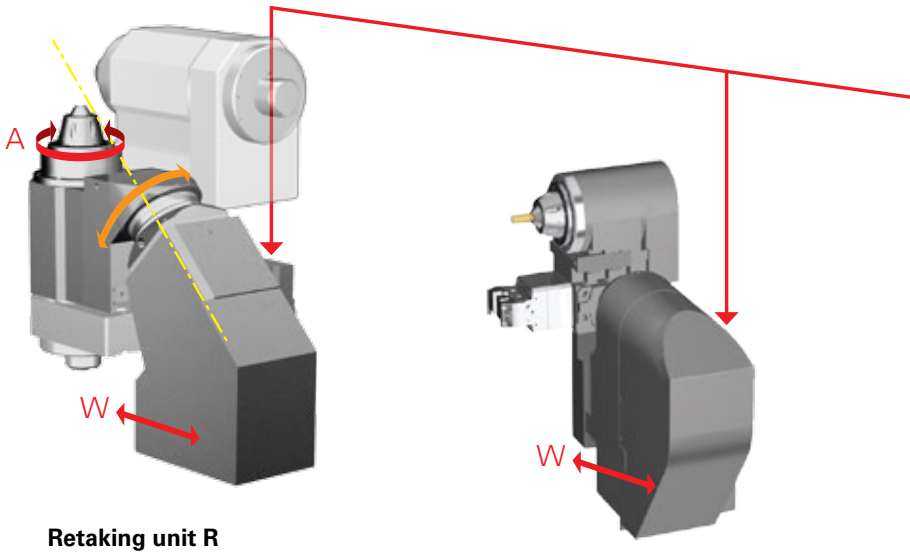
- Tailored solution for customers manufacturing
- Multiple combinations possible
- Mill/Turn and more





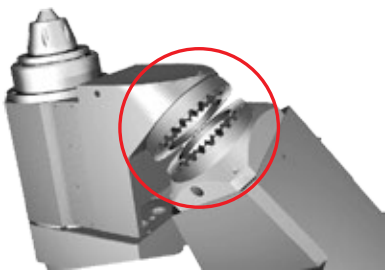


Multiple machining set-ups
The multipurpose Bumotec s191H enables the manufacturing of most complex parts, 6-sided in one set-up.



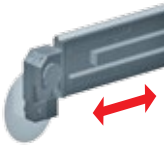
Retaking unit R
- Full subspindle
- Horizontal/vertical positioning/machining
- Max. power: 15 kW
- Max rpm: 6000 min^{-1}
- Max torque: 36 Nm
- Identical to mainspindle

Retaking unit PRMC
- Power: 11,1 kW
- Torque S1/S6: 13 /34 Nm
- Max spindle speed: 6000 min^{-1}
- Max C-axis speed: 90 000°/min

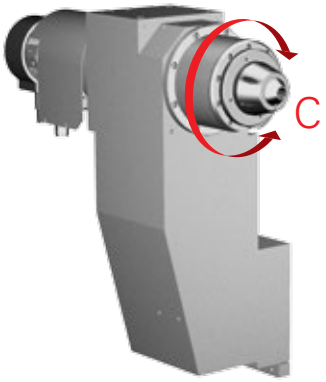


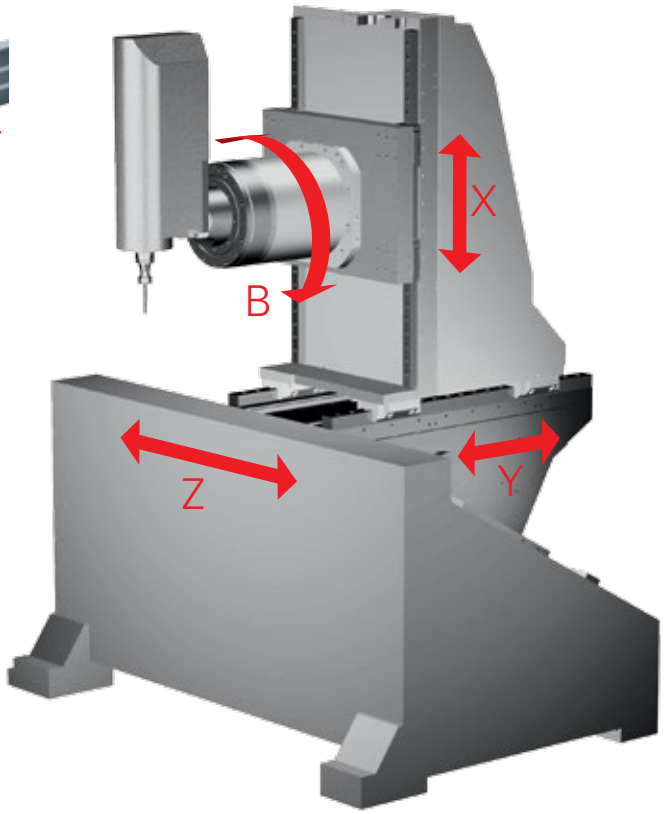
High precision and strength locking
R / PRM / PRC are positioned and locked by HIRTH coupling perfect alignment with main-spindle.

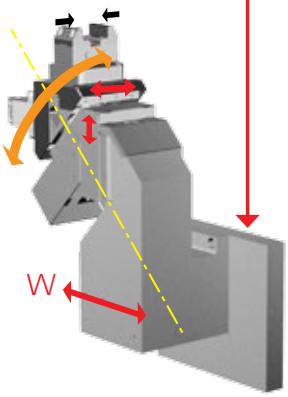
Independant cut-off unit
Integrated in travelling column, for cut-off of very fine or non-symmetric parts, when taken by the subspindle, working with circular saw.



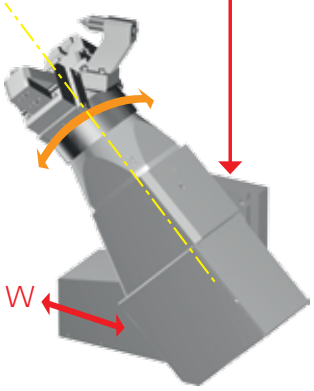
Mainspindle C
- Direct drive
- Bar capacity: Ø32/50/65 mm
- Max rpm: 6000 min^{-1}
- Max torque: 124 Nm



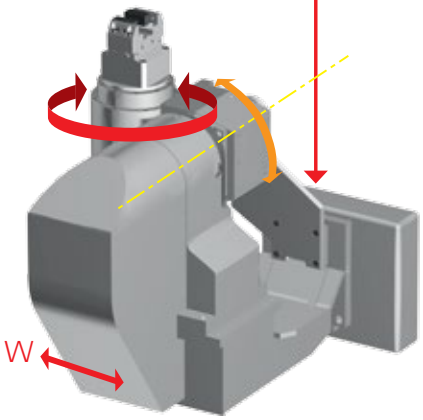




Retaking unit P
- Horizontal/vertical positioning
- Different clamping systems
- Sitting on W-axis



Retaking unit PRM
- 4 positions revolving unit
- 2 clamping positions (vice/collet/chuck)
- 1 tailstock



Retaking unit PRC
- Integrated C-axis positioned perpendicular to the bar
- Max rpm: 72 000 °/min
- Max torque: 35 Nm

MODULARITY

- Vast range of clamping devices
- Perfect solution for each part

SK50 or SK65 collets

W20 collets

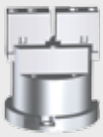
Ottet form collets

F38 or F48 collets

F38 or F48 collets

Ottet form collets

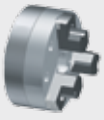
Profile/extrusions clamping system



2 jaw selfcentering clamping device

2 jaw selfcentering clamping devices

3 jaw chuck



3 jaw chuck

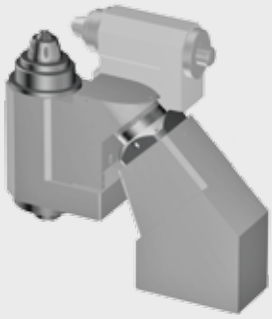
Special clamping unit for watch paltines

Accessories for main spindle and retaking spindle
A vast range covers all clamping requests for blanks or bars. Integrated stoppers associated to a clamping pressure allow one to fix the most delicate or massive part.

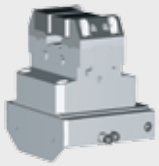
Clamping systems for retaking units
Vices, collet systems or tailstocks are available. Customers special systems can be integrated when needed.

Modularity
The majority of all clamping devices can be interchanged between the spindles and retaking units.

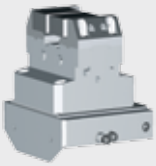
Ø32 / 50 / 65 mm



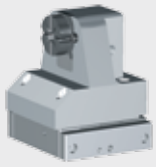
Ottet
form collets



Self-centering
vice



Self-centering
device

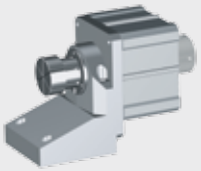


Small collet clam-
ping system
for small parts

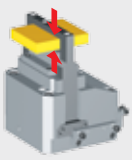
3 jaw chuck

Tailstock

Tailstock

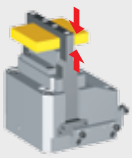


OTTET
form collets

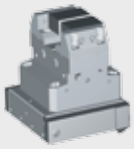


Vertical
clamping unit

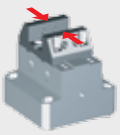
F38 collets



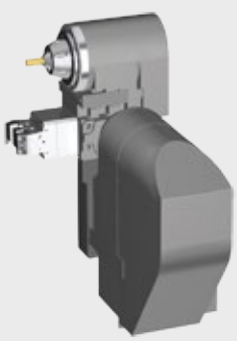
Vertical clamping
unit

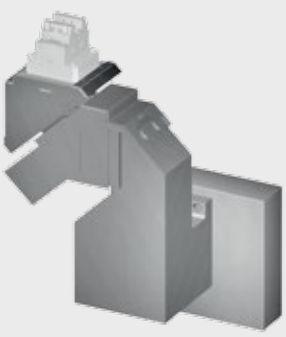


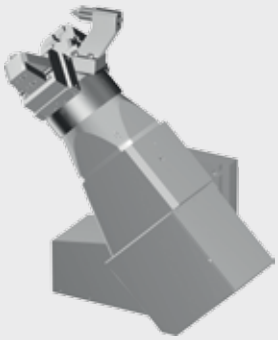
Self-centering
vice

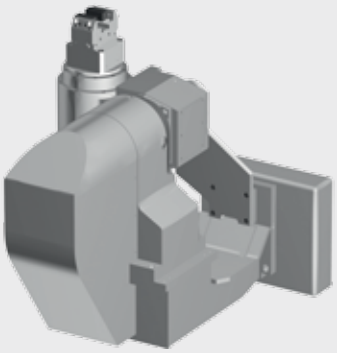


Self-centering
vice



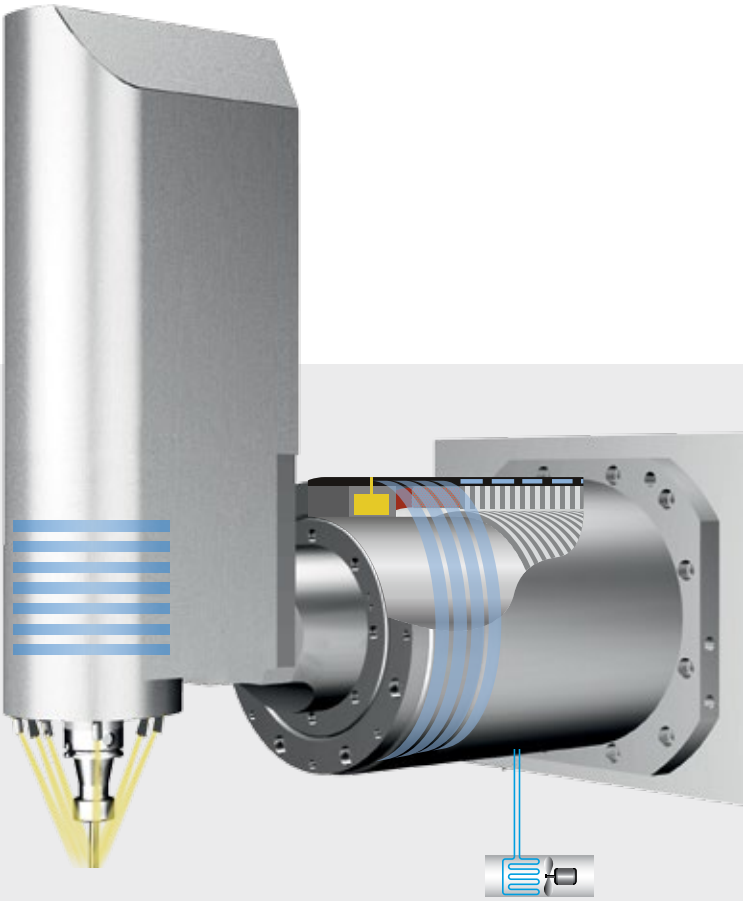






THE WORKING SPINDLE

- High speed and torque
- Outstanding rigidity
- Designed for longevity



SWIVELLING B-AXIS

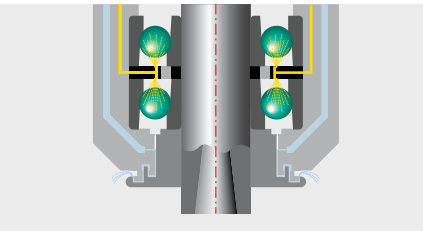
The machining spindle carrier axis is controlled by a torque motor with 226 Nm (339 Nm on the «Plus» model) with the following advantages:
- Outstanding positioning and movement response characteristics.
- Excellent surface quality
- High speed design (0° to 90° in 0,35 s)
- Free of any backlash
- Zero lifetime wear

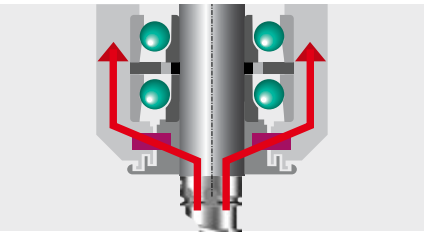
Through spindle coolant
The spindle is designed for through spindle coolant pressure up to 100 bar.

B-axis and spindle cooling
Outstanding results during 5-axis simultaneous machining and TCP (ToolCenterPoint) programming. Stable dependable accuracy at all times.

ADVANTAGES OF THE SPINDLE

Speed and Longevity
Ceramic hybrid ball bearings support:
- High accelaration
- High constant speed
- High rigidity

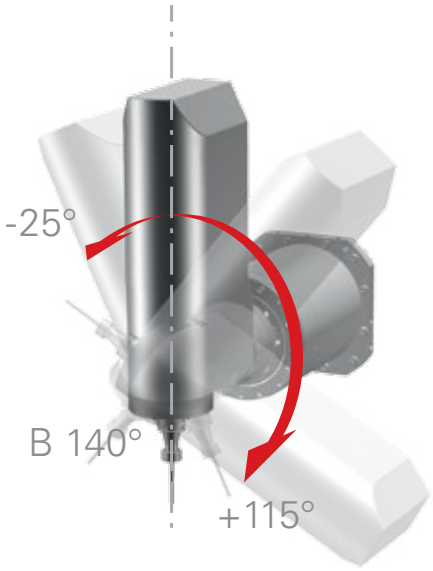




Sealing
A pressurized labyrinth seal keeps contaminants out.

Oil-Air lubrication
Supporting high spindle speeds and longevity.

Shock protection
An ingeniuous design guarantees precise positioning of non-rotating tools (e.g. turning) at 8 x 45° while protecting transmission of shocks to the hybrid bearings for exceptional longevity.



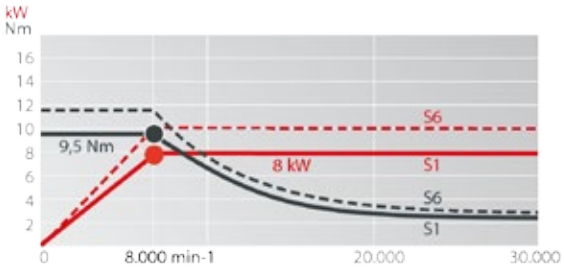
B-Axis
Swivelling spindle
The machining spindle is mounted on B-axis direct drive with 226 Nm (339 Nm on the «plus» model).
The generous swivel range grants uncompromised machining access at all angles for a perfect 5 sided part.
HSK40 or CAPTO C4
Different toolholder interfaces adapted to the customers machining need allow the exploitation of the latest cutting tool technology available.

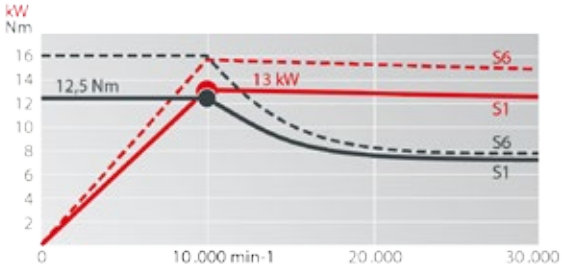
s191H Ø32/50 mm

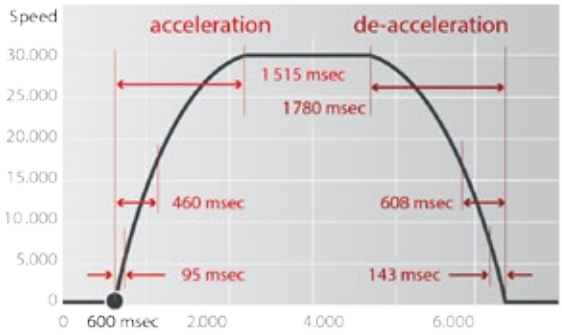
B-Axis	Power S1 / S6	Torque S1 / S6
	4,3 kW	106/226 Nm
Working Spindle	**Power S1 / S6**	**Torque S1 / S6**
	8 kW (9,6 kW)	9,5 Nm (11,5 Nm)

s191H Ø65 mm Plus

B-Axis	Power S1 / S6	Torque S1 / S6
	4,3 kW	166/339 Nm
Working Spindle	**Power S1 / S6**	**Torque S1 / S6**
	13 kW (16 kW)	12,5 Nm (15,5 Nm)







High ramp-up / ramp-down with the Bumotec working spindle
The spindle ramps-up in an instant to correspond with the high positioning speed of the axes.

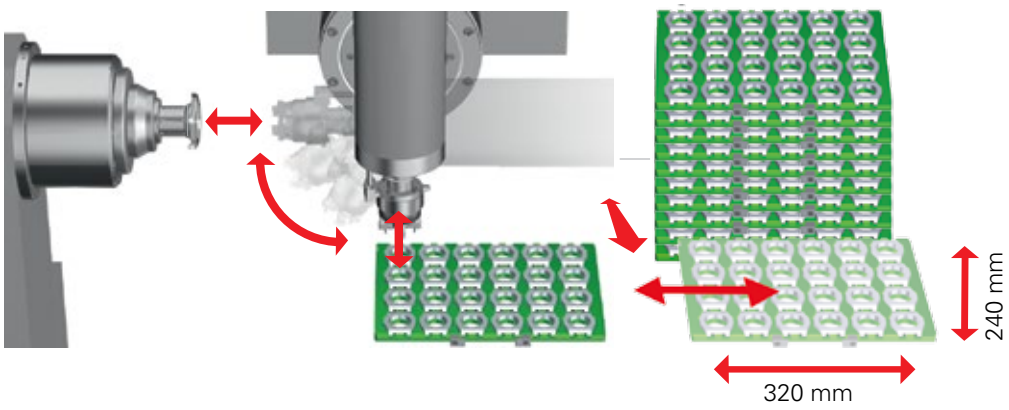
OPTIONAL FUNCTIONS

- Anglage
- 40 000 min^{-1}
- Package horizontal rectification (hard material machining)

AUTOMATION

- Upscale autonomy
- Unmanned production

Automation
A completely integrated loading/unloading unit enables highest autonomy at lowest invest. No referencing needed when changing parts. Parts handling through spindle grippers in the working spindle (stored in the tool magazine). Simple use of the machine axes. The pallet magazine can store raw parts as well as rapid indexing pallet systems such as 3R, Mecatool, Yerly and others.



Integration
Bumotec integrates on customers demand other loading/unloading solutions.

The Bumotec machining centers can be used as stand-alone machines or as manufacturing cells and can be built up into flexible production systems.

ACCESSORIES

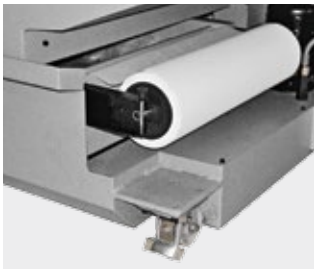
A huge range of equipment to increase the s191H performance.

Fixed touch probe
A touchprobe allows the measuring / breakage- wear check of rotating and non-rotating tools in 3 axes. Interactive menus facilitate the use for the operator.

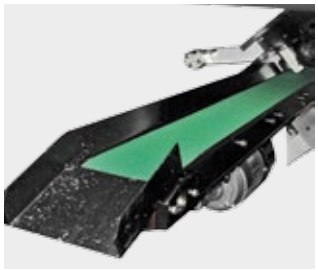
Spindle probe
The spindle probe helps to check certain criteria in production, or to shift reference points for the machining of castings/forgings.

Chip conveyors
Different models allow the perfect conception according to the customers needs.

Automatic barfeeders
Different set-ups and makes available, for short/long bars, with or w/o automatic barfeed.



Paperbond chip conveyor
Perfect for precious metals. The paper density defines the filtering quality.



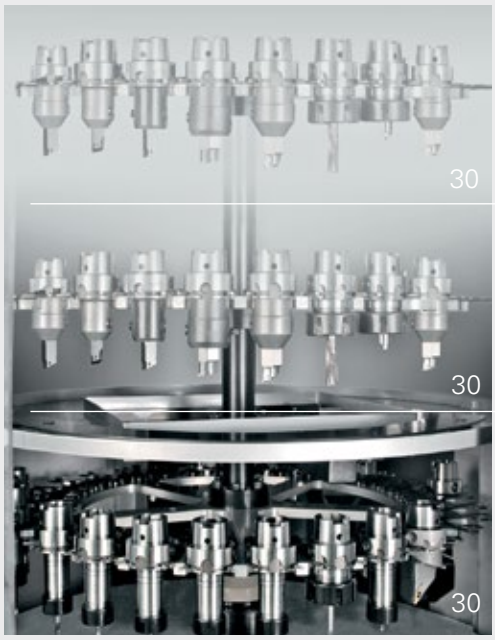
Parts Conveyor
A conveyor belt assures the smooth transport of produced parts out of the working zone.

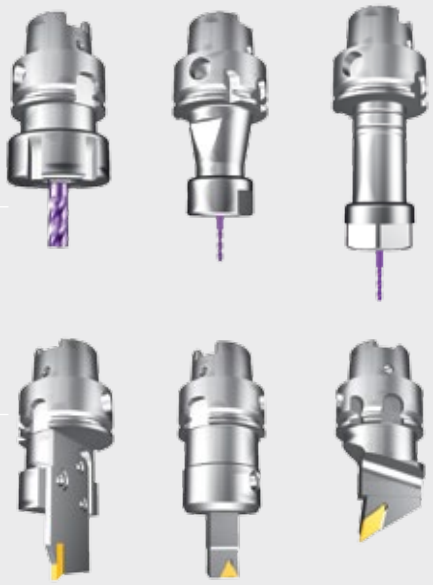
High pressure coolant pump
The unit is 100% independent:
- Full-stream cooling of cutting fluid
- Full-stream filtering down to 5 µ
- Automatic reverse-flow filtering, w/o disposables
- Pressure up to 100 bar
- Volumetric pump at 25 l/min

THE TOOL MAGAZINE

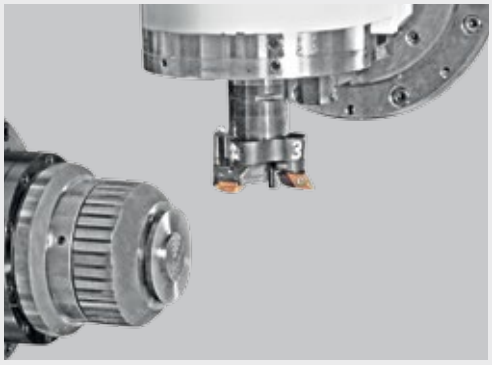
- 30 / 60 / 90 tool pockets
- HSK40 or Capto C4

Tool Magazine
30, 60 or 90 tool pockets. All tools, regardless of milling or turning, are stored on 30 pocket discs.
The tool always returns to their initial position. Tool change in 1,8 s. Very good accessibility to magazine out of working zone.

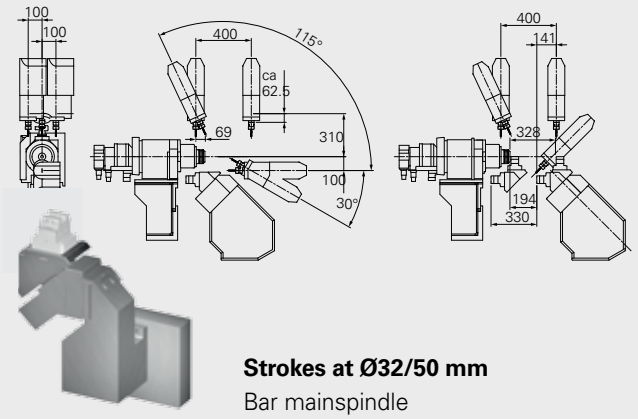




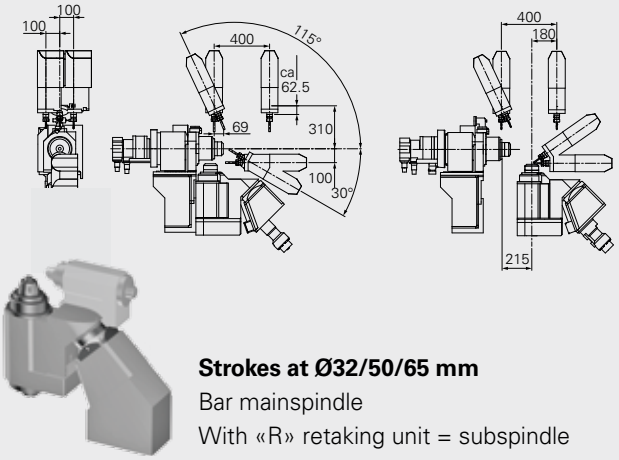
Special tool holders
2-, 3-, or 4 cutting tips tool holders increase productivity, as they are used like a turret in the working spindle, thus saving a lot of tool-change-time.



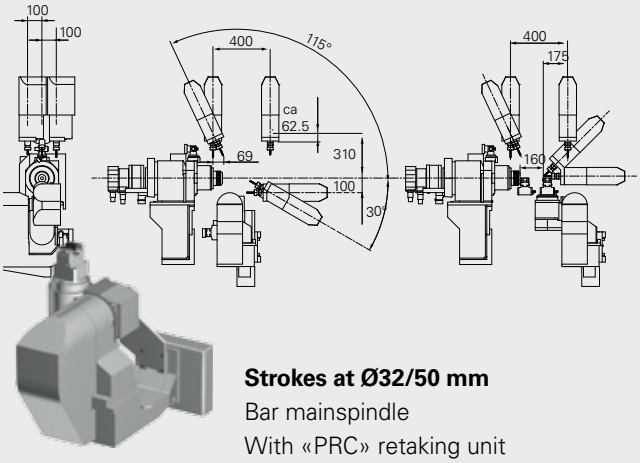
MACHINE TRAVEL LAYOUT



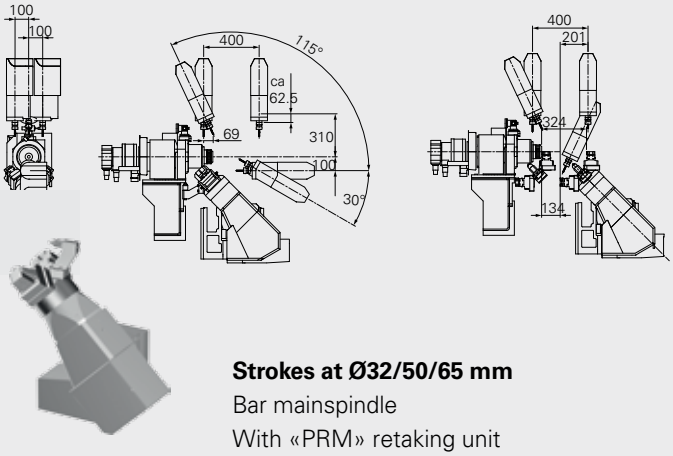
Strokes at Ø32/50 mm
Bar mainspindle
With «P» retaking unit



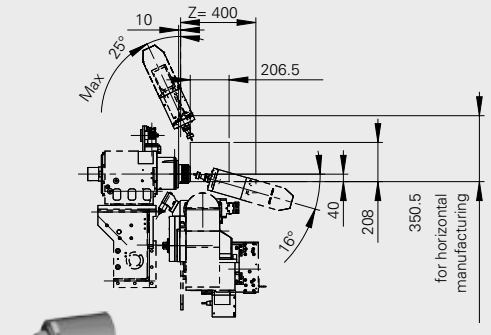
Strokes at Ø32/50/65 mm
Bar mainspindle
With «R» retaking unit = subspindle



Strokes at Ø32/50 mm
Bar mainspindle
With «PRC» retaking unit



Strokes at Ø32/50/65 mm
Bar mainspindle
With «PRM» retaking unit



Retaking unit PRMC
Bar mainspindle
With «PRMC» retaking unit

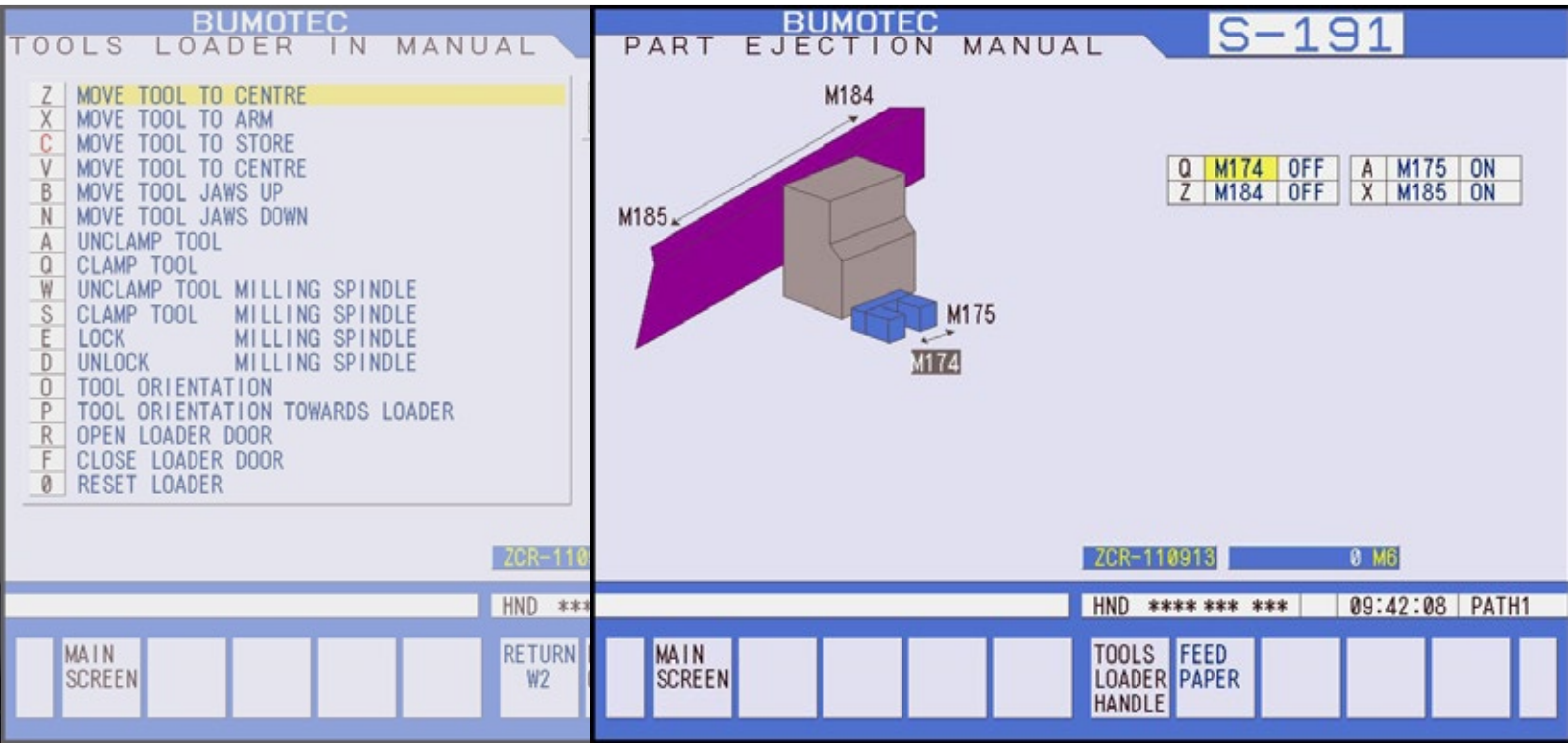
CERAMIC MACHINING

A set of dedicated options, designed to the machining of ceramic and other hard materials, is available:

- HF spindle (150 000 min^{-1})
- Laser tool check
- Working zone entirely in stainless

THE FANUC 31i CONTROL

- State-of-the-art control technology
- Smooth Bumotec man-machine-interfaces



All machine setting
A lot of the menus are dedicated to the basic characteristics of the machine. So, the machining programs are not relating to the specific machine data. Full interchangeability between the machines is given.

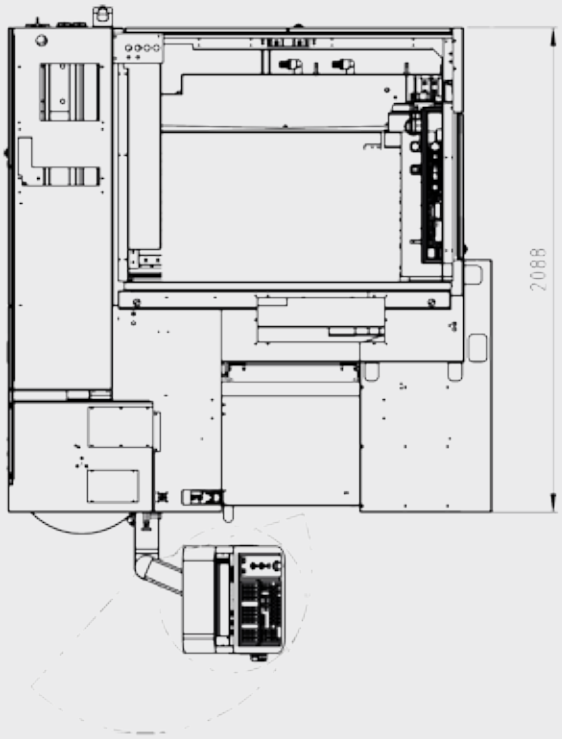
Ease-of-use
Bumotec has developped a vast array of smooth interactive subroutines, helping to simplify the programming.

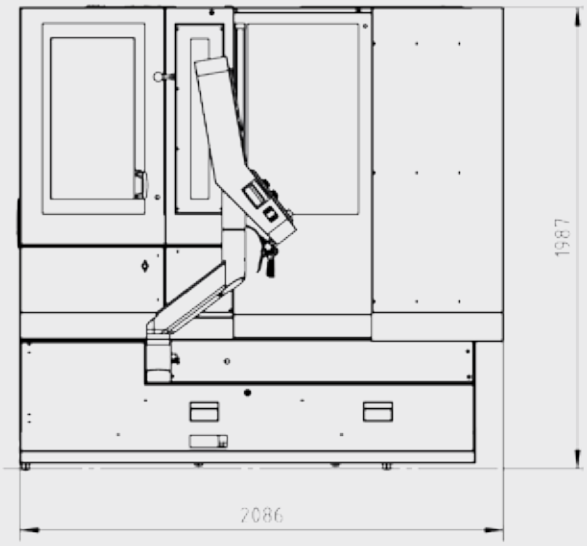
TECHNICAL DATA

F = Milling
FT = Mill/turn
X-Y-Z-W ball screw or Y-Z linear drive (L)

		s191 Ø32 mm	s191 Ø50 mm	s191 Ø65 mm
Base machine				
Axis stroke		Z= 400 mm / Y= 200 mm / X= 410 mm		
Power/Axis force	Z-Y	4,8 kW / > Z= 550 daN / Y= 240 daN		
	X	7,2 kW / > 360 daN		
Rapids	X-Y-Z	50 m/min		
Acceleration	X-Y-Z-W	10,4m/s² (1,2 g)		
Resolution	X-Y-Z-W	0,0001 mm		
Main Spindel C				
Power (direct drive)		15 kW	15 kW	15 kW
Torque S1 S2 S3		22 / 27 / 36 Nm	41 / 51 / 68 Nm	84 / 104 / 124 Nm
Rpm turning		6000 min⁻¹ (8000 option)	6000 min⁻¹	6000 min⁻¹
Rpm milling		90 000 °/min	90 000 °/min	90 000 °/min
Clamping force		F = 4900 at 6 bar	F = 7400 N at 6 bar	F = 7400 N
		FT = 38 000 N at 30 bar	FT = 38 000 N at 30 bar	FT = 47 000 N at 30 bar
Resolution		0,0001°	0,0001°	0,0001°
Bar capacity		Ø32 mm	Ø50 mm	Ø65 mm
Clamping systems		F38/Ottet/Mecatool/Jaw-chuck	F48/Ottet/Mecatool/Hainbuch/Jaw-chuck	F48/Ottet/Mecatool/Hainbuch/Jaw-chuck
Tilt axis B (direct drive)				
Torque cont/max		106/226 Nm		166/339 Nm
Tilting speed		36 000 °/min (7.500 °/s²) (0 at 90° in 0,35 s)		
Blocking torque		200 Nm		200 Nm
Resolution		0,0001°		0,0001°
Tilting range		-25° / +115°		-25° / +115°
Milling spindle				
Power S1/S6		8 kW		13 kW
Torque S1/S6		S1 = 9,5 Nm/S6 = 11,5 Nm		S1 = 12,5 Nm/S6 = 15,5 Nm
Max rpm		30 000 min⁻¹ (40 000 option)		30 000 min⁻¹
Tool holder clamping force		2000 N		2000 N
Locking system		Mechanical locking with straight gears		Mechanical locking with straight gears
Tool interface		HSK-A-40		HSK-A-40 (CAPTO C4 option)
Max through spindle coolant pressure		100 bar (option)		100 bar (option)
Tool changer				
Capacity		30 (option 60 or 90) HSK40 (option Capto C4)		
N° of turning tools		All tools possible		
Tool change time		1,2 s		
Chip-to-chip time		3,2 s		
Max tool weight		1,2 kg		
Max.Tool diameter		40 mm (80 if adjacent tool pockets are empty)		
Max Tool length		130 mm (150 mm on one tool magazine disc)		
CNC control				
Type/Screen		FANUC 30 series type 31iA-5 / 15"		
Retaking options				
On W-axis				
Axis stroke		330 mm		
Power/axis force		2,5 kW / 550 daN		
Rapid		40 m/min (8,3 m/s²)		
Resolution		0,0001 mm		
Retaking vice				
Self-centering parallel-vice		pneumatic		
Clamping force		4200 N at 6 bar		
Other clamping devices		ID or OD collets / OTTET form collets		
Resolution		0,0001 mm		
Subspindle (A-axis)				
Power (direct drive)		15 kW		
Torque S1 / S2 / S3		22/27/36 Nm		
Rpm turning		6000 min⁻¹		
Rpm milling		90 000°/ min		
Clamping force		9500 N at 5 bar		
Resolution		0,0001°		
Clamping systems Depth in subspindle at diameter		L = 400 at dia 32 mm	150 mm at dia >37 mm / 400 mm at dia <37 mm	
4 positions retaking unit		F38 / F48 / Ottet / Mecatool / Hainbuch / Jaw-chuck		
N° of possible clamping posts		3		
Clamping systems		Vice / tailstock / ID or OD collets / Ottet form collets		
Weight				
Machine (without any options)		4200 kg		

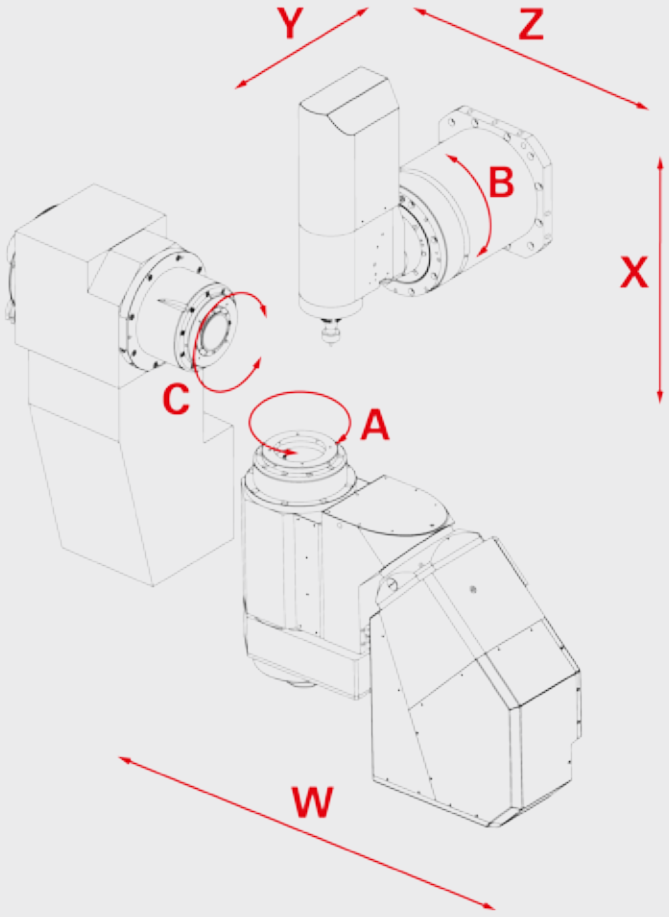
FOOTPRINT





AXIS CONFIGURATION

s191H (with retaking spindle)



www.starrag.com

Starrag Vuadens SA
Rue du Moléson 41
1628 Vuadens
Switzerland

P +41 26 351 00 00
F +41 26 351 00 99

vudadmin@starrag.com
www.starrag.com